Adam Equipment

CBK-M SERIES

Service Manual

Software rev.: 4.07 & above

ADAM EQUIPMENT CO. LTD.
P.N. 9017, Rev. A3, October 2007

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1.0 INTRODUCTION

- The **CBK-M** series of scales provide an accurate, fast and versatile general purpose weighing scales with counting, percent weighing and check-weighing functions.

- **CBK-M** scales are kilogram only scales.

- There are 4 models with capacities up to 30kg.

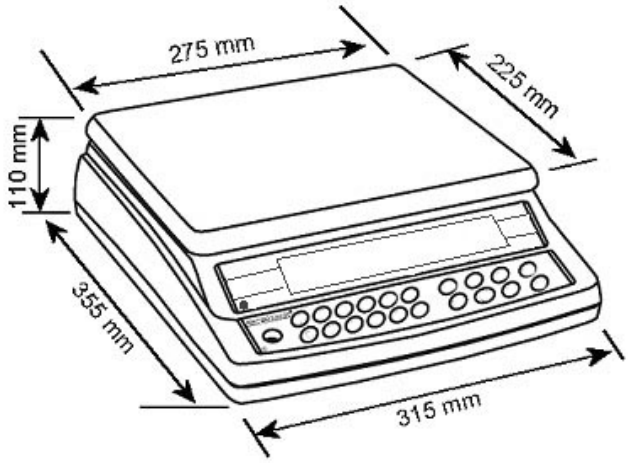
- The scales have LEDs to indicate when a weight is below the low limit, between the limits or above the high limit next to the display. These can work in conjunction with an audible alarm for check weighing as well as LCD showing LO, OK and HI.

- The scales have stainless steel weighing platforms on an ABS base assembly.

- All scales are supplied with a RS-232 bi-directional interface and real time clock (RTC). **NOTE:** For Approved applications, CBK-M Scales do not come with the RS-232 interface. However, the scales can be supplied with RS-232 interface if they are not to be used for approved applications.

- The scales have sealed keypads with colour coded membrane switches and a large easy to read liquid crystal type display (LCD) supplied with a backlight.

- The scales include automatic zero tracking, semi-automatic tare, accumulation facility that allows the count and weight to be stored and recalled as an accumulated total.



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2.0 SPECIFICATIONS

	CBK 3M	CBK 6M	CBK 15M	CBK 30M
Grams				
Max	3000 g	6000 g	15000 g	30000 g
d =	1 g	2 g	5 g	10 g
n =	3000	3000	3000	3000
Kilograms				
Max	3kg	6kg	15kg	30 kg
d =	0.001kg	0.002kg	0.005kg	0.01 kg

OTHER SPECIFICATIONS

Units of measure	Kg, g
Interface	RS-232 bi-directional Interface **NOTE:** For Approved applications, CBK-M Scales do not come with the RS-232 interface. However, the scales can be supplied with RS-232 interface if they are not to be used for approved applications.
Stabilisation Time	2 Seconds typical
Operating Temperature	-10°C to 40°C / 14°F to 104°F
Power supply	115/230 VAC Mains, 50/60 Hz or 9 VDC, 800 mA through an external adapter
Battery	Internal rechargeable battery (~90 hours operation)
Calibration	Not available
Display	6 digits LCD digital display with capacity tracker and symbol for unit
Scale Housing	ABS Plastic, Stainless Steel platform
Pan Size	225 x 275 mm / 8.9” x 10.8”
Overall Dimensions (wxdxh)	315 x 355 x 110 mm 12.4” x 14” x 4.3”
Net Weight	4.1 kg / 9 lb
Applications	Weighing Scales
Functions	Weighing, Parts counting, % weighing, Check weighing, Check counting, Accumulation of weights
Date/Time	Real Time Clock (RTC), To print date and time information- battery backed. **NOTE:** For Approved applications, CBK-M Scales do not come with the RS-232 interface.

3.0 TROUBLESHOOTING

PROBLEM	POSSIBLE CAUSE
Display is blank No turn on test	Power Switch faulty or not connected Battery not charged or faulty Power supply faulty or incorrect type
"- - - - - -"appears on display	Maximum capacity exceeded Load Cell damaged Electronics is faulty
Display is unstable	Drafts or air currents Obstruction under pan Sample is moving (animal weighing) Vibrations through table Temperature changed dramatically Electronics faulty or Battery low
Weight value incorrect	Calibration error, Recalibrate Unit calibrated with inaccurate weight Balance not level Obstruction between sample pan Wrong unit of weight displayed
Cannot use Full Capacity	Over-load Stops hitting pan support or hitting bottom of load cell Electronics faulty Parameters set incorrectly Load Cell Damaged
Not Linear	Overload stops hitting too soon Faulty factory calibration

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Off Centre Loading error	Overload Stops not correct Obstruction under pan
Battery will not charge	Charging circuit failure Battery Failure Incorrect adapter (below 800 mA) Processor failure

4.0 ERROR CODES

ERROR CODE	DESCRIPTION	POSSIBLE CAUSES
Err 1*	Time input Error	Invalid time entry such as "268970" for the time format "**H-m-S**".
Err 2*	Date input Error	34th day of a month is an invalid entry.
Err 4	Initial Zero is greater than allowed (4% of maximum capacity) when power is turned on or when the **[Zero/Enter]** key is pressed.	Weight on the pan when turning the scale on. Excessive weight on the pan when zeroing the scale. Platform is not installed. Improper calibration of the scale. Damaged load cell. Damaged Electronics.
Err 6	A/D count is not correct when turning the scale on.	Load cell is damaged. Electronics is damaged.
Err 7	Percent input error	Percent function is entered with no reference mass on the pan.
Err 8	High limit input error	Low limit is set first, then the high limit is set lower than the low limit and high limit not equal to zero.
Err 9	Low limit input error	High limit is set first, then the low limit is set higher than the high limit and low limit not equal to zero.
FAIL H or **FAIL L**	Calibration error	Improper factory calibration). The old calibration data will be retained until the calibration process is complete.
***Err 1** and **Err 2** are not applicable for scales used in approved applications.		

5.0 CBK-M DESCRIPTION

The CBK-M scales have an enclosure with all components mounted within it. To gain access to the components remove the 5 screws securing the cover to the base.

The basic unit consists of:

- ✓ Base
- ✓ Load Cell frame
- ✓ Power switch
- ✓ Main PCB assembly
- ✓ Battery
- ✓ Display PCB assembly
- ✓ Keypad

All models of CBK-M are similar except the selection of load cells and the program.

Normally if a problem is found with a circuit board the most cost effective method of solving the problem is to replace the circuit board.

The main PCB assembly includes:

- ✓ A/D converter (AU1),
- ✓ Microprocessor (DU1) and
- ✓ Power supply/battery charger circuits (DU5, T2).

6.0 LOAD CELL DAMAGE

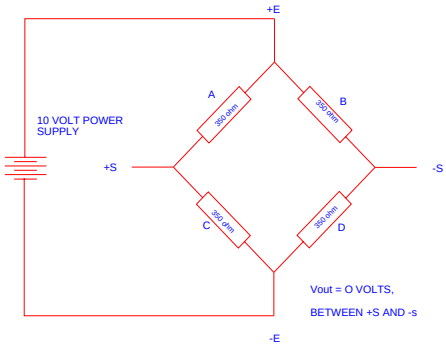
The most common reason why a scale fails is that the load cell has been damaged. The damage can be from 2 primary causes. The first is physical damage due to an overload or an impact from the side and the second is damage due to the environment, such as moisture, extreme heat or a cut cable if the cables are exposed.

PRINCIPLE OF OPERATION

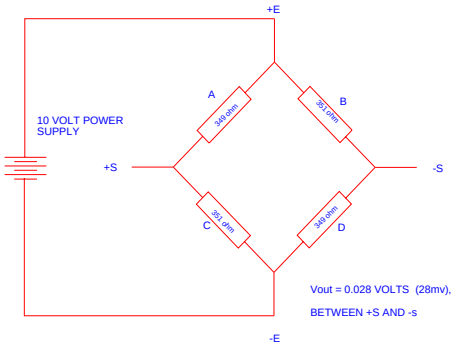
The stain gauge load cell is a method of measuring the amount of stress put onto a metal structure due to a weight being supported by the structure. The stress is measured using 4 strain gauge sensors mounted in a particular way on the metal structure.

These 4 strain gauges are connected in such a way that they form a Wheatstone Bridge. See figure below. In the simplest load cells there are only the 4 resistances of the strain

gauges to consider. Normally without a load on the load cell all the resistances are the same. However when the load cell has a weight on it 2 of the strain gages will be in compression (A and D) and the resistance will decrease and 2 will be in tension (B and C) and their resistance will increase.



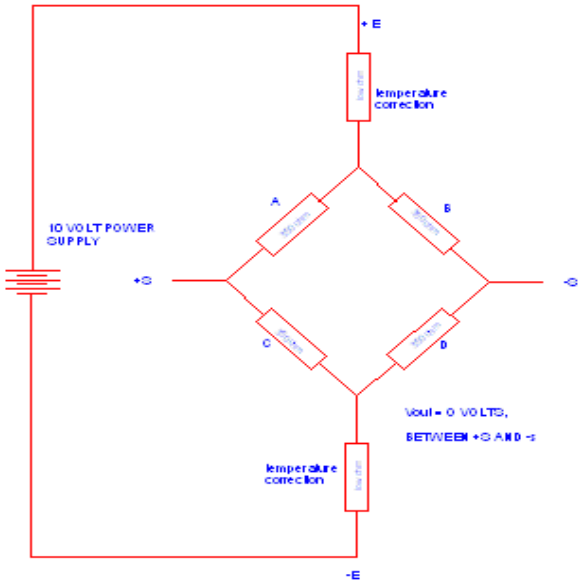
BALANCED BRIDGE



UNBALANCED BRIDGE
FULL CAPACITY LOAD
ON THE LOAD CELL

This will cause the bridge to become unbalanced. When the bridge has a voltage across it from +E to -E then the signal output at +S and -S will show a voltage of zero volts with no load and a small voltage proportional to the load as the load is increased. Typical load cells show 20-30mv of signal if the excitation voltage is 10volts and the load cell is fully loaded.

Most load cells used in scales are not as simple as this example. They have additional resistance elements added to compensate for temperature variations and to set the outputs to correct voltages. The circuit of a typical load cell is shown below-



BALANCED BRIDGE

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A method to check the basic function and integrity of a load cell can be done using a ohmmeter and voltmeter with up to a 10volt power supply.

Before the load cell is connected to the power supply use the ohmmeter to measure the resistance between the wires. Typical resistance values are:

+E to -E	410 ohms ±30 ohms
+S to -S	350 ohms ± 2 ohms

+E to +S or any other combination similar approximately 270 ohms.

If the load cell has Sense connections in addition they are connected to the excitation internal to the load cell.

Connect the load cell +E and -E to a power supply, typically 10 volts. Never use more than 12 volts as it may damage the load cell.
Measure the voltage between +S and -S.

With no load the voltage should be approximate 0mv ±3mv.

With a mass on the load cell the output voltage should increase. The amount by which it increases will be dependent upon the sensitivity of the load cell, capacity of the load cell, the excitation voltage and the amount of mass placed on the load cell. Most load cells have a sensitivity of either 2mv/V or 3mv/V.

The expected change to the output is:

$$Vout = \frac{(2mv/V) * Vext * Mass}{\text{capacity of load cell}}$$

For example a 2mv/V load cell of 30Kg capacity with 20Kg placed on it. Vext is 5 volts would give a output of approximately:

$$Vout = \frac{(2mv/V) * Vext * Mass}{\text{capacity of load cell}} = \frac{2mv/V * 5V * 20Kg}{30kg} = 6.7mv$$

If the load cell has been damaged the no load voltage will likely be greater than 3mv or the loaded voltage will be grossly different from the expected value. Remember the loaded voltage will be offset by the amount of zero load voltage measured.

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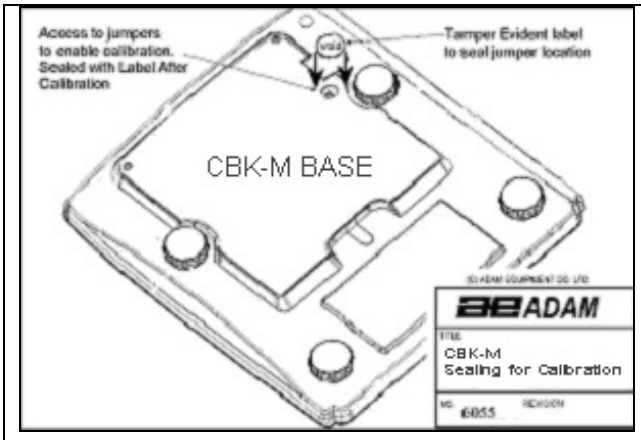
The load cell can be tested while it is connected to the A/D converter circuit board, using the scale power supply for excitation voltage.

TESTING LOAD CELLS IN THE SCALE

The signal from the load cells is amplified by the circuits on the A/D circuit board. The signal needs to be amplified to make it acceptable for the A/D converter used. The CBK-M scales amplify the input by 200 and change the no load voltage to about +2.5V. The amplified and offset voltage is measured at pin 6 of IC7, the INA118P amplifier IC. This voltage is sent to the filter and then to the A/D converter.

7.0 CALIBRATION

The CBK-M Scales are sealed to prevent unauthorised calibration.


Access to jumpers to enable calibration. Sealed with Label After Calibration
Tamper Evident label to seal jumper location
CBK-M BASE
ADAM
CBK-M
Sealing for Calibration

The calibration of the CBK-M scale is accomplished by removing the label at the base of the scale which covers a hole through which the PCB can be accessed. If your scale is not provided with this hole, you need to break the security seals and remove the top cover to gain access to the circuit boards inside. See the figure on the security seal below.

<u>WARNING:</u> CALIBRATION OF THE CBK-M SCALE MAY MAKE IT ILLEGAL TO USE THE SCALE FOR SOME APPROVED APPLICATIONS. CONTACT YOUR TRADING STANDARDS OFFICE FOR FURTHER ASSISTANCE.

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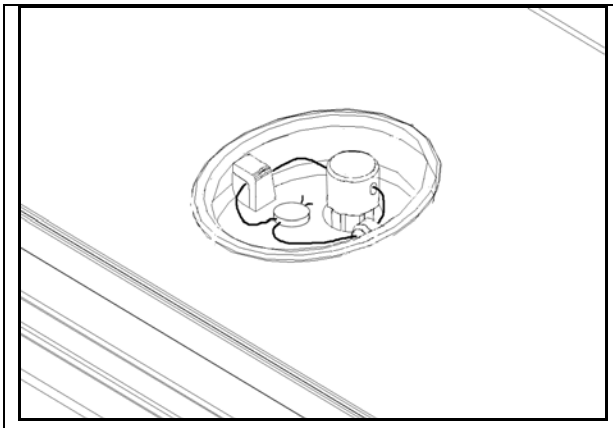
7.1 SECURITY SEALS



To seal the scale a lead-wire seal can be used as shown below. The base has a metal pin that protrudes through the cover. The security seal may be threaded through this metal pin, making it impossible to remove the cover without damaging either the security seal or the enclosure.

Metrology labels and additional security measures may be added to the scale as required by the national legislation.

An alternative method of sealing the scales is to have a seal covering the joint between the base and cover. If this seal is broken the scale must be sealed by the relevant authorities, using either the lead wire seal or an acceptable seal between the cover and base.

7.2 CALIBRATION PROCEDURE

The scales are sealed to prevent unauthorised calibration. See section 8.1 for details.

If calibration is not possible, the load cells or PCBs may have been damaged. Contact Adam Equipment or the supplier.

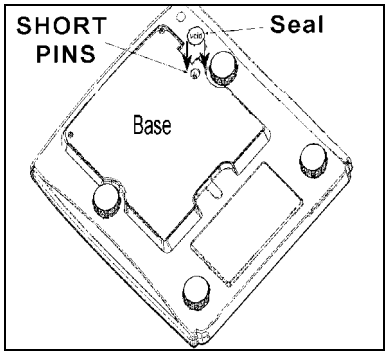
CBK-M scales need to be re-calibrated if the variation in gravity takes place due to change in location or if the calibration done earlier was not correct.

As per the requirements of the Metrological authorities the scales should be verified for use after calibration.

8.0 FACTORY PARAMETERS

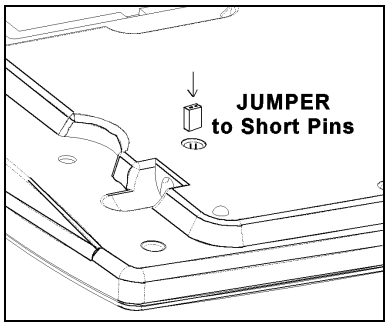
The factory parameters are used performing the factory calibration, setting the capacity and other basic settings.

To access these parameters place a jumper into the pins on the main PCB (marked as position J4) through a hole provided on the base of the scale.



Turn the scale upside down.

Remove the seal covering the hole to access the PCB.



Place a jumper through the hole into the pins. If a jumper is not available, short the pins.

Turn on the scale using the switch on the base.

"P _ _ _ _" Enter "2006" and press **[Tare]**

After the jumper has been placed in the position shown, apply power to the scale.

The display will show the software revision number and then ask for a code number, "**P _ _ _ _** ".

Enter the number 2006 and press **[Tare].**

The display will show the first parameter "**F1 CAL**". To scroll through other parameters press the **[Func]** key.

The display will show the parameter number then the word describing the function.

Press the **[Tare]** key to enter a parameter.

Press the **[Zero]** key to exit the factory parameter section. Display will show "**JP on**". Remove the jumper. The scale will return to weighing.

When a parameter is entered by pressing the **[Tare]** key, the display will guide you through the parameter selected and the options available.

The parameters available are:

F1	**CAL**	To enter the Calibration
F2	**rES**	Resolution selection, not valid for approved units
F3	**CAP**	Select Capacity
F4	**int**	Initial Zero Range
F5	**rE Z**	Re-Zero Range
F6	**SCS**	Successive Tare Enable
F7	**Cnt**	Display the A/D counts
F8	**ZE M**	Set zero method
F9	**Ld M**	Set low voltage detect mode

8.1 F1 -CALIBRATION

"*F1 CAL*"	Press **[Tare]**
"*UnLOAd* "	Empty the pan by removing the load, if there is any and press **[Tare]**
"*Ld1 xx* **kg**"	Load the first calibration weight and press **[Tare]**
"*Ld2 xx* **kg**"	Load the second calibration weight and press **[Tare]**
" *PASS*"	Calibration is complete. Remove the calibration weight.
Or, "*FAiL L* "	This means calibration has failed. Remove the calibration weight and repeat the process.
"*JP on*"	Remove the jumper or shorting of the pins whichever is used. The scale will return to normal weighing.

Suggested Calibration Weights:

	Calibration weight 1	Calibration Weight 2
CBK 3M	1 kg	2 kg
CBK 6M	2 kg	4 kg
CBK 15M	5 kg	10 kg
CBK 30M	10 kg	20 kg

8.2 F2 -RESOLUTION

NOTE: This value can not be changed for the CBK-M scales.

8.3 F3 – CAPACITY

To enter this parameter, press the **[Tare]** key when "**F3 CAP**" is shown.

The display will show the current capacity.

Press the **[Func]** key to scroll through the options.

Press **[Tare]** to accept the displayed value and return to the parameter or press the **[Zero]** key to return to the parameter without changing the value.

Then press **[Func]** to advance to the next parameter.

NOTE: The scale must be originally built for the capacity selected. The 3 kg unit uses the 5 kg load cells, 6 kg unit uses 10 kg load cells, the 15 kg unit uses 20 kg load cells and the 30 kg unit uses 35 kg load cells.

8.4 F4 -INITIAL ZERO RANGE

To enter this parameter, press the **[Tare]** key when "**F4 int**" is shown.

The display will show the current initial zero range.

Press the **[Func]** key to scroll through the options.

Press **[Tare]** to accept the displayed value and return to the parameter or press the **[Zero]** key to return to the parameter without changing the value.

Then press **[Func]** to advance to the next parameter.

8.5 F5 -RE-ZERO RANGE

To enter this parameter, press the **[Tare]** key when "**F5 reZ**" is shown.

The display will show the current re-zero range.

Press the **[Func]** key to scroll through the options.

Press **[Tare]** to accept the displayed value and return to the parameter or press the **[Zero]** key to return to the parameter without changing the value.

Then press **[Func]** to advance to the next parameter.

8.6 F6 -SUCCESSIVE TARE

To enter this parameter, press the **[Tare]** key when "**F6 SCS**" is shown.

The display will show if the successive tare is "**tr on**" or "**tr oFF**".

Press the **[Func]** key to scroll through the options.

Press **[Tare]** to accept the displayed value and return to the parameter or press the **[Zero]** key to return to the parameter without changing the value.

Then press **[Func]** to advance to the next parameter.

8.7 F7 -A/D COUNT

To enter this parameter, press the **[Tare]** key when "**F7 Cnt**" is shown.

This parameter allows you to view the A/D counts from the internal A/D converter. This can be an aid to service.

Press the **[Tare]** key to return to the PARAMETER menu.

Typical value at zero is 30,000-90,000 (approx.)
Typical value at full capacity is 500,000 (approx.)

8.8 F8 –ZERO

This parameter allows the normal method of setting zero.

To enter this parameter, press the **[Tare]** key when "**F8 ZEro**" is shown.

The display will show the current settings, "**modE 1**" or "**modE 2**".

Press the **[Func]** key to scroll through the options.

Press **[Tare]** to accept the displayed value and return to the parameter or press the **[Zero]** key to return to the parameter without changing the value.

Then press **[Func]** to advance to the next parameter.

8.9 F9 –LOW VOLTAGE DETECTION

This parameter allows detection of low voltage when the battery wears down.

To enter this parameter, press the **[Tare]** key when "**F9 Ld M**" is shown.

The display will show if the LVD Mode is set to **on** or **oFF**.

Press the **[Func]** key to scroll through the options.

Press **[Tare]** to accept the displayed value and return to the parameter or press the **[Zero]** key to return to the parameter without changing the value.

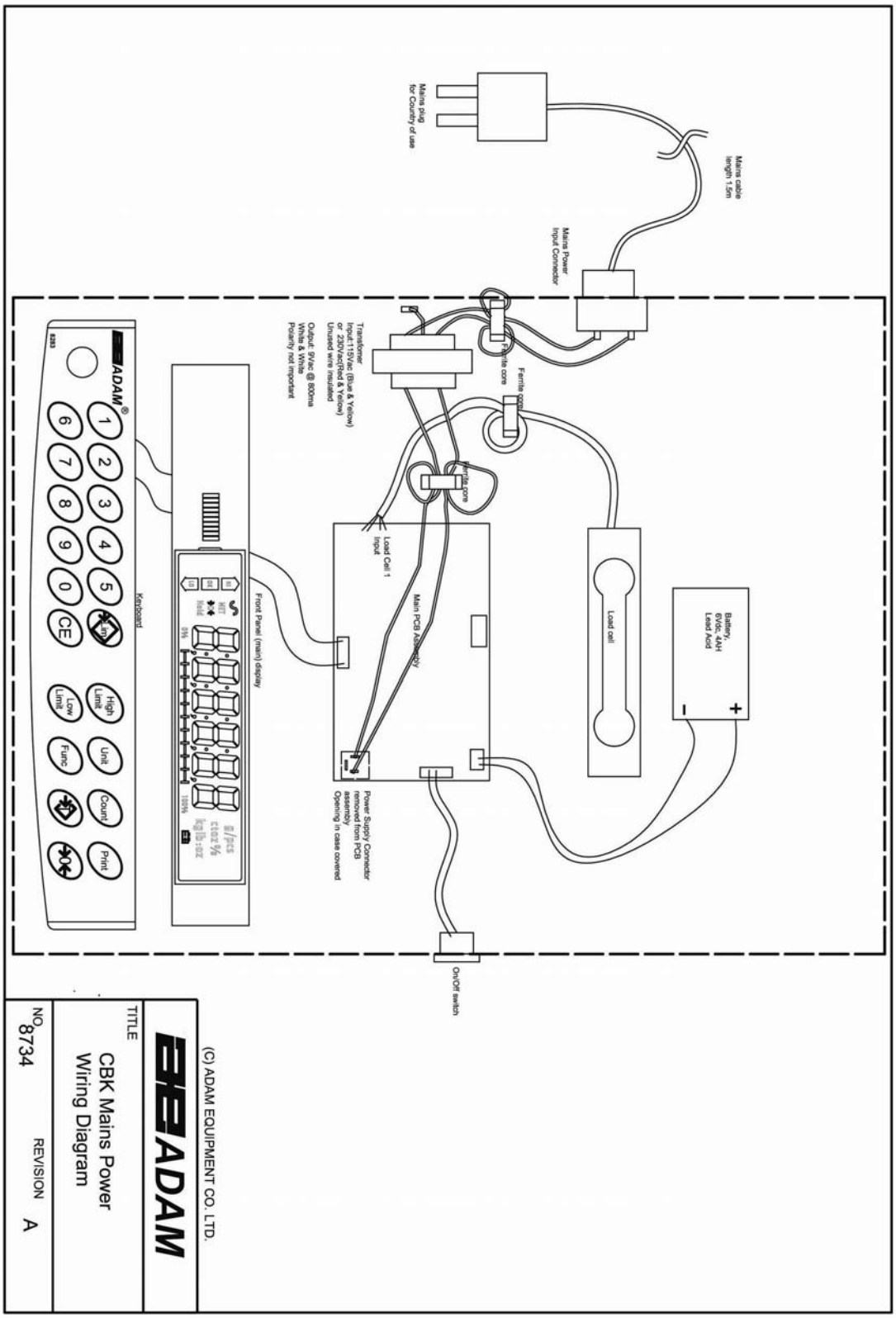
Then press **[Func]** to advance to the first parameter.

Pressing **[Zero]** will display "**JP on**" indicating the jumper is still in place. Switch off the scale and remove the jumper.

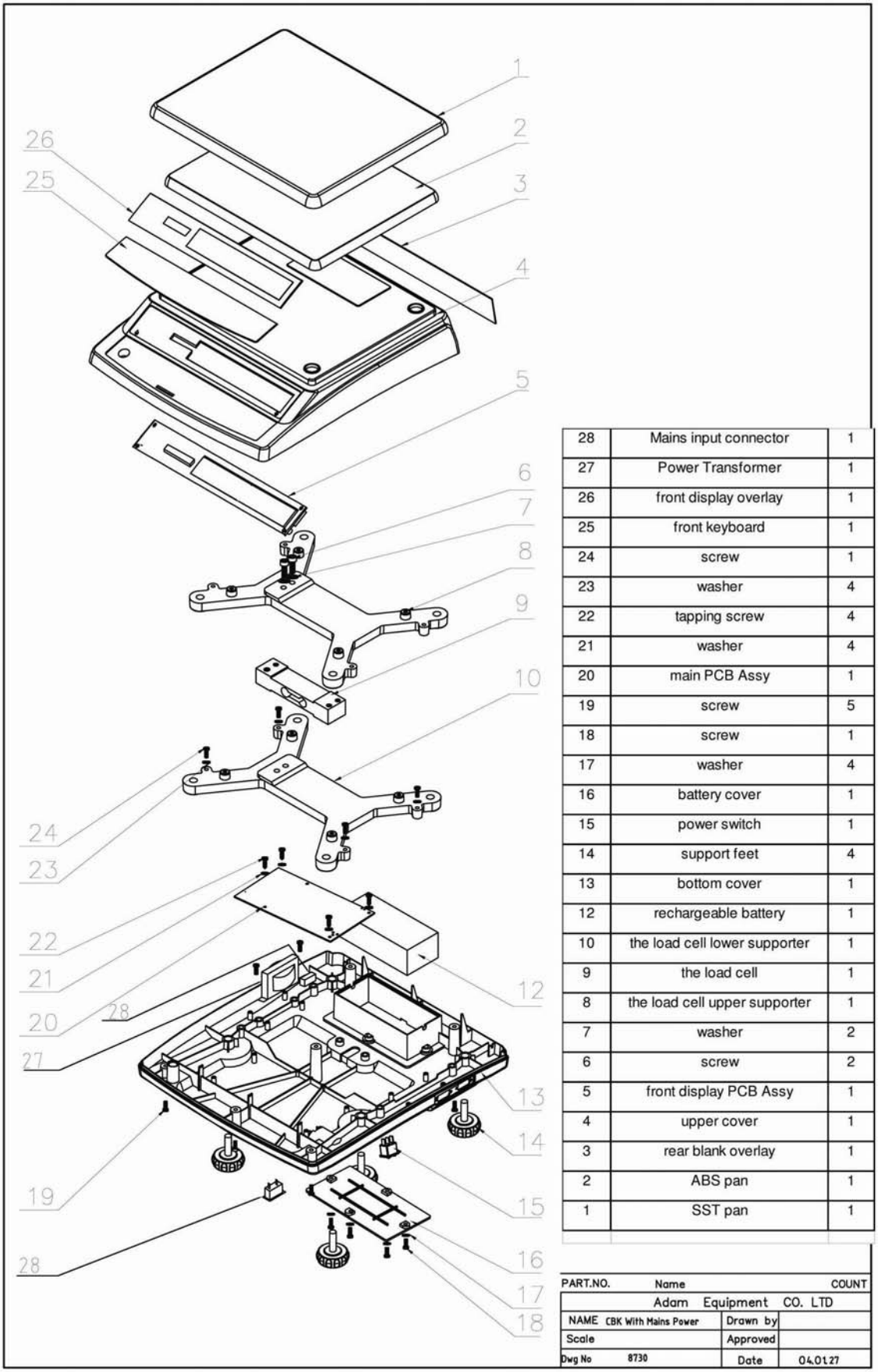
NOTE : TO SECURE THE SCALE, IT IS NECESSARY TO REMOVE THE JUMPER AND RE-SEAL THE SCALE.

NOTE: The scale has a special feature for displaying x10 the value of the weight which is a useful tool during testing. Press the **[1]** key for more than 3 seconds. It will show one extra decimal place making it a high resolution display. Pressing the **[1]** key again for more than 3 seconds will bring the display back to the normal resolution.

9.0 WIRING DIAGRAM



10.0 MECHANICAL ASSEMBLY



28	Mains input connector	1
27	Power Transformer	1
26	front display overlay	1
25	front keyboard	1
24	screw	1
23	washer	4
22	tapping screw	4
21	washer	4
20	main PCB Assy	1
19	screw	5
18	screw	1
17	washer	4
16	battery cover	1
15	power switch	1
14	support feet	4
13	bottom cover	1
12	rechargeable battery	1
10	the load cell lower supporter	1
9	the load cell	1
8	the load cell upper supporter	1
7	washer	2
6	screw	2
5	front display PCB Assy	1
4	upper cover	1
3	rear blank overlay	1
2	ABS pan	1
1	SST pan	1

PART.NO.	Name		COUNT
	Adam Equipment CO. LTD		
NAME CBK With Mains Power		Drawn by	
Scale		Approved	
Dwg No 8730		Date	04.01.27

ADAM
Adam Equipment
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E-Mail Address: info@Adamequipment.co.uk

CE

Test Certicifate **Test certificaat**
Prüfzertifikat **Certificato di prova**
Certificat de test **Certificado de prueba**

The non-automatic weighing instrument
Die nicht- automatischen Wägeapparate
L'instrument de pesage à fonctionnement non automatique

Het niet –automatische weegwerktuig
Strumento per pesatura non automatico
Imstrumento para pesaje non automatico

III

Manufacturer :	Adam Equipment Co. Ltd.
Type:	CBK-M
No of the EC type-approval certificate:	T7249 / TC7248
Corresponds to the production model described in the EC type-approval certificate and to the requirements of the Council Directive 90/384/EEC as amended and to the requirements of the following EC Directives:	
73/23/EEC	Electrical equipment for use within certain voltage limits (Low Voltage Directive)
89/336/EEC	Electromagnetic compatibility

Hersteller :	Adam Equipment Co. Ltd.
Typ:	CBK-M
Nr. der EG-Bauartzulassung:	T7249 / TC7248
Entspricht dem in der Bescheinigung über die Bauartzulassung beschriebenen Baumuster, sowie den Anforderungen der EG-Richtlinie 90/384/EWG in der jeweils geltenden Fassung und den Anforderungen folgender EG-Richtlinien:	
73/23/EWG	Elektrische Betriebsmittel zur Verwendung innerhalb bestimmter Spannungsgrenzen (Niederspannungsrichtlinie)
89/336/EWG	Elektromagnetische Verträglichkeit

Fabricant :	Adam Equipment Co. Ltd.
Type:	CBK-M
N° du certificate d'approbation CE de type:	T7249 / TC7248
Correspond au modèle décrit dans le certificat d'approbation CE de type, aux exigences de la directive 90/384/CEE modifiée et aux exigences des directives CE suivantes:	
73/23/CEE	Matériel électrique pour utilisation dans des limites de tension définies (Directive Basse Tension)
89/336/CEE	Compatibilité électromagnétique

Fabrikant :	Adam Equipment Co. Ltd.
Type:	CBK-M
Nummer van de Verklarling van EG-typegoedkeuring	T7249 / TC7248
Conform met het model beschreven in de verklaring van EG-typegoedkeuring en met de voorschriften van EG richtlijn 90/384/EEC zoals gewijzigd en met de volgende EG richtlijnen:	
73/23/EEC	Laagspanning richtlijn
89/336/EEC	EMC richtlijn

Produttore	Adam Equipment Co. Ltd.
Modello:	CBK-M
N. di certificato di approvazione di tipo CE	T7249 / TC7248
Conforme al modello di produzione descritto nel certificato di approvazione de tipo CE e secondo le richieste CE direttivo 90/384/CEE come modificato e secondo le rechieste della seguente directive CE	
73/23/EWG	Strumenti elettrici per uso entro certi limiti di voltaggio (Directivo di voltaggio basso)
89/336/EWG	Compatibilita electromagnetico

Fabricante	Adam Equipment Co. Ltd.
Tipo:	CBK-M
Numaro del certificado de aprobacion de tipo CE:	T7249 / TC7248
Conforme al modello di producion descrito nel certificado di aprobacion del tipo CE e segun los requisitos del CE diretiva 90/384/CEE como modificato e segun los requisitos della siguiente diretive CE	
73/23/CEE	Instrumentos electricos para uso dentro cierti limites del voltaje (Diretivo di voltaje bajo)
89/336/CEE	Compatibilidad electromagnetico

Signature
Unterschrift
Signature
Handtekening
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J.S. Cumbach
Technical Manager

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1 October 2007

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ADAM EQUIPMENT is an ISO 9001:2000 certified global company with more than 35 years experience in the production and sale of electronic weighing equipment.

Adam products are predominantly designed for the Laboratory, Educational, Medical, retail and Industrial Segments. The product range can be described as follows:

-Analytical and Precision Balances
-Compact and Portable Balances
-High Capacity Balances
-Moisture analysers / balances
-Mechanical Scales
-Counting Scales
-Digital Weighing/Check-weighing Scales
-High performance Platform Scales
-Crane scales
-Medical Scales
-Retail Scales for Price computing

For a complete listing of all Adam products visit our website at
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